



Tomorrow today

Bldg. 16's Space Station cupola simulator seems like it's already been launched. Story on Page 3.



Class act

Payload Support System team at JSC receives a Space act award for its work on a safety data display. Photo on Page 4.

Space News Roundup

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No. 21

Discovery engines fail to get start order

By Kelly Humphries

The command to start *Discovery's* engines for the 22-second Flight Readiness Firing (FRF) was never given Thursday, apparently because a fuel bleed valve failed to close quickly enough.

The on-board launch sequencer computer inhibited the start command to all three Space Shuttle Main Engines (SSME) at the T-minus 5-second mark when it received a major component failure command from an engine controller. A "go" for main engine start had been given, and the hydrogen burn igniters were operating.

"We have elected to go directly into a 72-hour scrub turnaround," said Tip Talone, *Discovery's* flow manager. The decision was based on the need to replenish the hydrogen and oxygen farms and the need to give pad

workers a 24-hour break after three consecutive countdowns for the Wet Countdown Demonstration Test (WCDDT) and the FRF.

If the turnaround can be completed in 72 hours, the FRF will take place at 6:30 a.m. CDT Sunday. If a hardware malfunction must be taken care of, the FRF is expected to be delayed three days or a week more.

STS-26 Commander Rick Hauck, who witnessed the test at Kennedy Space Center, said the crew recognized that such delays can occur and is looking forward to learning the plan for resolving the problem.

"Although we were disappointed today's test

did not go full term, we were impressed with the professional manner in which the launch team responded to the situation," he said. "We maintain high confidence we'll get a good mission off in the near future."

"We did get a bunch of the special tests out of the way we had planned for tanking," said Talone. "We obviously got another good countdown run in

and everytime we run that we get a good training session for the crew.

"Today went very smoothly and from that standpoint the hardware performed very well down to that point. We think today was a plus

all the way down the line. We think this is something that can be pretty easily overcome and get through a good FRF the next time," he added.

Joe Lombardo, SSME project manager for Marshall Space Flight Center, said the fuel bleed valve, opened prior to engine start to allow liquid hydrogen to circulate and cool the engine, only reached the 24-percent closed position when the sequencer automatically aborted the firing. The valve was supposed to have reached the 20-percent closed position two seconds after the close command was given. The valve was in the process of closing completely, and the two-second check is used to assure that the valve is closed by the time the engines start.

Please see **TEST**, Page 4.



STS-26 The Return to Flight



Clamshell device top repair option for oxidizer leak

A "clamshell" approach developed by JSC and Rockwell International is now the primary option for on-the-pad repair of a tiny oxidizer leak in *Discovery's* left Orbital Maneuvering System (OMS) pod.

Space Shuttle program managers meeting Tuesday at Kennedy Space Center gave a preliminary go-ahead to proceed with a repair at the pad. The decision will be reconsidered after a full review of data from the Flight Readiness Firing.

Using the primary repair option is expected to add no more than one to two weeks to the launch processing flow for STS-26. The added work will be factored into the schedule, but won't necessarily result in a corresponding delay in the launch date.

The clamshell approach would involve cutting through *Discovery's* bulkhead to get at the leak in a half-inch diameter dynatube fitting for the Reaction Control System (RCS) oxidizer tank overflow vent. Two halves of the clamshell would be clamped together around the dynatube fitting, and sealant would be injected into the shell and around the fitting.

Engineers in JSC's Propulsion and Power Division, working in parallel with Rockwell engineers at Downey, Calif., developed the external approach as NASA's entire manned spaceflight center team knuckled down to develop and evaluate various approaches to the nitrogen tetroxide leak. Marshall Spaceflight Center engineers developed an internal plugging repair approach that will be considered as an alternative for at least another week.

"We've had a little competition almost going, and everybody is trying to find the best answer," said Brian Morris, head of the Propulsion Test Section that was chosen to develop a repair procedure because of its

familiarity with the oxidizer and its qualities.

Tests of both the external and internal approaches indicated *Discovery* could be flown with confidence after the fix, although some certification testing of materials and techniques continues. The JSC/Rockwell approach was given precedence primarily because it was further along in development and testing.

Paul Svejkovsky, a Lemsco employee, has been developing a prototype clamshell and clamp at JSC, Morris said. Wednesday, he flew to White Sands Test Facility to fit check the device on an OMS pod there. If his prototype fit, he was to continue on to Rockwell's California facility for further tests and comparisons with the test articles developed there.

Morris said the top two sealant materials being tested at JSC are a carbon-filled silicon made by Furmanite, and a fluorosilicone with Teflon kneaded in made by Team. The materials are being tested for their compatibility with the nitrogen tetroxide (N2O4).

"It should be compatible with N2O4 so that it won't be destroyed by the N2O4 and have the leak start again," he said. "But there is no material other than Teflon that's totally compatible with it."

The materials being tested are compatible in that they swell when put in contact with the oxidizer in lab tests, but retain their integrity when taken away from the oxidizer.

Frank Wang, senior scientist in the Bldg. 350 Materials Laboratory, said he has been testing the materials in contact with the oxidizer since July 22.

The sealants also are being tested under about 3,000 pounds of pressure, Morris said.

"We're pumping the material in this

Please see **LEAK**, Page 4.

Brian Morris, head of the Propulsion Test Section, displays a mockup of the clamshell-like device developed by workers at JSC and Rockwell that is the leading contender for repairing *Discovery's* Reaction Control System leak on the pad. The clamshell device will fit over the leaking dynatube fitting, be clamped together and be filled with sealant.

Five from JSC to spend year at Headquarters

Professional Development Program trains participants through experience

Five JSC employees will have the opportunity to expand their working knowledge and skills at NASA Headquarters this year through the Professional Development Program.

Through the program, NASA field center professionals are selected for a 12-month developmental work assignment at Headquarters, while selectees from Headquarters are sent to field centers under the same guidelines.

The work assignments provide

experience in new tasks and functions and are supplemented with formal classroom education, dependent on an individual's needs.

The five JSC representatives going to Headquarters for the 1989 fiscal year will be Dr. Michael W. Bungo, director of the Space Biomedical Research Institute; Harold "Bill" Conway of the Systems Engineering and Integration Office; Dr. Winston Goodrich, deputy chief of the Aerospace Branch in the Advanced

Programs Office; Donald Morrison of the Experimental Planetology Branch in the Solar System Exploration Division; and Leroy Villarreal of the Systems Management Branch in the Data Processing Systems Division. Three of the selectees—Conway, Morrison and Goodrich—reported to Headquarters on Monday.

Conway, who has been at JSC for 23 years, reported to the Solar System Exploration Division, where he will serve as program manager for the

Mars Rover/Sample Return mission. He also will work with the Office of Exploration, and he will act as manager for the Advanced Mars and Lunar mission.

Morrison, a JSC employee for 21 years, also reported to the Solar System Exploration Division. He will work with advanced planning and administration for the Cosmic Dust Collection Facility and the Mars rover and Lunar observer.

Please see **PROGRAM**, Page 4



Bungo



Morrison



Goodrich



Conway

JSC People

Cullingford is certified

Dr. Hatice S. Cullingford, Ph.D., assistant to the chief for advanced development in the Solar System Exploration Division, recently became the second JSC employee to be honored as a certified manager in the Institute of Certified Professional Managers. The certificate is an "acknowledgement of professional competence in the field of management" and is "in recognition of demonstrated knowledge, skill, experience and ethics." The certificate is renewable in five years if 50 hours of study in continuing education within the management field are completed. Cullingford, a Clear Lake resident, has been with JSC for four years. She has served in her current capacity since March.



Cullingford

Thank you to helpers

The Space News Roundup received the following letter recently from a Clear Lake area child in appreciation for the help of two anonymous employees:

Dear Sirs,
I wish to thank two thoughtful NASA gentlemen for helping me on June 14. I was riding my bicycle on Space Center and hit some loose gravel and went down.

They came by and helped me and even brought me home. I later went to the hospital and had 11 stitches. Since I was hurting so badly, I didn't get their names. But I wish to thank them for their kindness in this letter.

Sincerely,
Lance Montgomery

JSC

Dates & Data

Today

Circus—Tickets for a noon performance of the Ringling Bros. and Barnum & Bailey Circus on Aug. 13 are available in the JSC Exchange store for \$6.

Astros vs. Dodgers—Tickets for field level seats to see the Houston Astros play the Los Angeles Dodgers at 7:35 p.m. Saturday are available for \$7 each at the Bldg. 11 Exchange Store.

Cafeteria menu—Entrees: tuna and salmon croquette (special), pork chop with yam rosette, creole baked cod, seafood gumbo. Vegetables: brussels sprouts, green beans, buttered corn, whipped potatoes.

Saturday

Children's lunch—A luncheon theater for children, featuring the Texas Mime Theater, jugglers and a clown, will be sponsored by the JSC-EAA at noon in the Rec Center. Tickets are \$2.50 for adults and children at the Bldg. 11 Exchange Store. For more information, call Susan Starkweather, x36608.

BAGSUG meeting—The Bay Area GS Users Group (BAGSUG) will meet at 2 p.m. at the Thomas Avenue Baptist Church. For more information, call Demetrius Roberts at 476-0069.

Monday

Beginning tennis—Beginning tennis lessons begin and will meet each Monday from 5:15-8:45 p.m. at the Rec Center. Cost is \$32. Call x30304 for more information.

Cafeteria menu—Entrees: Italian outlet (special), enchiladas with chili, chicken a la king, braised beef ribs, cream of broccoli soup. Vegetables: navy beans, brussels sprouts, whipped potatoes.

Tuesday

Benefits information—A representative from the Government Employees Hospital Association Benefit Plan will be in Bldg. 45, Rm. 203 from 9 a.m.-1 p.m. to explain claims procedures, claims problems and benefits information.

Cafeteria menu—Entrees: stuffed cabbage (special), round steak with hash browns, turkey and dressing, beef and barley soup. Vegetables: corn coblette, okra and tomatoes, French beans.

Wednesday

Hispanic symposium—Astronaut Dr. Franklin Chang-Diaz will speak at the Hispanic Symposium on Science, Engineering and Technology Careers beginning at 9 a.m. and continuing daily through Friday. Sponsored by the NASA, JSC and the Center for the Advancement of Science, Engineering and Technology (CASET), the symposium will be held in the Rec Center. For more information, contact CASET at 483-9313.

Secretaries meet—The Clear Lake/NASA chapter of Professional Secretaries International will have a social and dinner beginning at 5:30 p.m. and a business meeting at 7 p.m. in the NASA Rd. 1 Holiday Inn. Pete Billac, author of "How Not to be Lonely," will speak. Cost of dinner is \$9. For reservations, call Mary Todd at 282-3942.

EAA badging—Dependents and spouses may apply for pictured identification badges between 6:30-8:30 p.m. in the Gilruth Recreation Center. For more information, call x30304.

Cafeteria menu—Entrees: pepper steak (special), roast pork with dressing, catfish with hush puppies, seafood gumbo. Vegetables: broccoli, macaroni and cheese, stewed tomatoes.

Thursday

Graduate registration—Registration for several graduate engineering courses to be offered this fall by JSC in cooperation with the University of Houston Cullen College of Engineering will be held in the Bldg. 45 lobby from 10:30 a.m.-2 p.m. For details, call Glen Van Zandt at x33069.

Cafeteria menu—Entrees: chicken fried steak (special), Hungarian goulash, barbecue ham steak, beef tacos, turkey and vegetable soup. Vegetables: spinach, pinto beans, beets.

Aug. 12

MAES banquet—The NASA area professional chapter of the Mexican American Engineering Society (MAES) will hold its fifth annual scholarship banquet at the University of Houston. A social hour will begin at 7 p.m. followed by dinner and the program at 8 p.m. For more information, contact Dalia Riojas, x33815, or Mary Flores, x37284.

Cafeteria menu—Entrees: tuna and noodle casserole, roast beef with dressing, deviled crabs, liver and onions, seafood gumbo. Vegetables: whipped potatoes, peas, cauliflower.

Aug. 16

EAA badging—Dependents and spouses may apply for pictured identification badges between 6:30-8:30 p.m. in the Rec Center.

Aug. 18

Weight safety—A required course for employees wishing to use the Rec Center weight room, it will be offered from 8-9:30 p.m.

Aug. 20

Defensive Driving—A course in defensive driving will be offered from 8 a.m.-5 p.m. at the Rec Center. Cost is \$20. For more information, call x30304.

Aug. 21

Family fun day—The JSC-EAA will sponsor a family fun day at AstroWorld from 10 a.m.-10 p.m. Admission is \$9.95 with an EAA coupon.

Aug. 25

Softball tournament—Registration deadline for teams to sign up for the Men's Open C softball tournament scheduled Aug. 27-28 is at 5 p.m. Only the first 14 entries will be accepted. Cost is \$95. Call x30304 for details.

Aug. 26

SEDS conference—The Texas area chapters of the Students for the Exploration and Development of Space will sponsor an international conference at the Nassau Bay Hilton through Aug. 28. The conference will feature JSC tours, a space career exposition and several well known speakers from the space industry. For more information, call Peter Lange, x30850.

Sept. 9

AIAA China trip—A technical delegation from the Houston Section AIAA will depart for a trip to China to visit with the Chinese Society of Astronautics. Participants will meet with technical counterparts in Chinese space facilities at Beijing, Xian

and Shanghai, home of Houston's sister section, the Shanghai Astronautical Society. Non-technical activities are planned for spouses. The delegation also will visit scenic and historic sites at Guilin and Hangzhou. For information on applications, call Jim McLane, 488-0312.

Sept. 15

Apollo 14 workshop—The Lunar and Planetary Sample Team will sponsor a workshop centering on Apollo 14 samples and the Apollo 14 landing site through Nov. 16 at the Lunar and Planetary Institute. Topics to be discussed include: regional geology of the Apollo 14 landing site; Apollo 14 plutonic rocks; and the relation of Apollo 14 lithologies to the magma ocean hypothesis and other models of early lunar differentiation. Abstracts for contributions are due at the LPI by Sept. 15. For more information, call Jeffrey Taylor, (505) 277-9159, or Paul Warren, (213) 825-2015.

Sept. 29

NACA reunion—The National Advisory Committee for Aeronautics (NACA) will be holding its fourth national reunion Sept. 29 through Oct. 2 in San Jose, Calif. NACA Reunion IV is for former employees, spouses and military detailees and will be held at the Red Lion Inn in San Jose. Super meeting saver air fare discounts are available with a savings of up to 40 percent from American Airlines in cooperation with Abel Love, Inc. For airfare information, call the JSC Travel Office at x38688. For other information, call x33067.

Oct. 13

Return to flight celebration—The eighth annual North Galveston County Chamber of Commerce's Bayou Festival will adopt "A Return to Space Flight Celebration" as its theme Oct. 15-16 at Walter Hall Park in League City. A return-to-flight banquet has been slated Oct. 13 at the South Shore Harbour Resort and Conference Center. As part of the festivities, a special award will be presented to the "North Galveston County Citizen Most Responsible for the Safe Return to U.S. Space Flight."

JSC

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2.

Property & Rentals

Lease: Baywind I condo, 1-1, downstairs, new carpet, \$300/mo. 333-6692 or 280-0642.
Sale/Lease: Fondren/SW traditional two-story, 4-2.5-2D, 2,400 sq. ft., formals, alarm, intercom, \$825/mo., or \$102,000 no-approval assum. 729-4447.

Sale: Inside lot at Rayburn Country, Jasper, Tex., 80' x 200'. 645-0008.

Sale: Pearland, Dixie Hollow subdivision, lot, all util., concrete street. 482-5003.

Sale/Lease: Forest Bend townhome, 2 story, 2-1.5-2CP, patio, storage room, W/D conn., \$375/mo. or \$45K. 482-2138.

Sale: League City, 3-2-2, cul-de-sac, landscaped, low equity, FHA 10% fixed assum. David, x35464.

Sale: Piper's Meadow, 3-2-2, 1,650 sq. ft., many extras, ex. cond., 11.5% assum., \$1,000 down, \$800/mo. 486-8998.

Sale: 3-2-2A, clean, low equity, 10% assum., no qualifying. 486-4505.

Rent: Lake Livingston waterfront, 3-2, fully furnished, covered decks, pier, ex. fishing, swimming, skiing, new cond. 482-1582.

Sale/Lease: El Dorado Way townhome, 2-2.5-2CP, FPL, W/D, refrig., fans, clubhouse w/sauna, exer. equip., pools, tennis/basketball court, \$485/mo. or \$43,000. Mike, x35574 or 280-9693.

79 Camaro, new paint, black/red int., new tires, ex. mech. cond. 280-7625 or 486-7590.

74 Datsun 260Z, auto., AM/FM, rebuilt carbs, 113K mi., good cond., \$2,375. OBO. x39573 or

488-5134.
'85 35' Mallard motor home, loaded, low mi., \$37,000. OBO. 337-4051.

'88 Chevrolet Beretta, new, auto. trans., A/C, AM/FM stereo, tilt, cruise, loaded, 37 mi., \$10,800. Debra, x35256 or 931-1651.

'69 Camaro Z28, yellow, AM/FM with cass., 4 spd., tinted windows, ex. cond., \$3,200. OBO. Leticia, x34183.

'88 Buick Skyhawk Wagon, 4 cyl., 37 mpg., 3,400 mi., loaded, assume loan, \$275/mo. 282-4263 or 488-2082.

'59 Mercedes Benz 220S, \$3,000. David, x35464.

'84 Pontiac 6000 SW, P/S, P/B, A/C, AM/FM stereo cass., top rack, ex. tires., \$4,995. OBO. B. Goodwin, 326-2494.

'87 Chevrolet Cavalier, 2 dr., 5 spd., A/C, AM/FM/cass., silver, black int. Laurie, x39173 or 488-3647.

'79 280ZX, good cond., new brakes/clutch, slight fender damage, but will supply new fender, LeBra, tint, rem. sunroof, louvers back and side, 70K mi., \$2,000. Kay, x52429 or 331-3379.

'80 Buick Regal, blue, int. ex. cond., some rust but looks and drives good, \$800. Susan, 331-3379.

'79 Honda Accord, 4 dr., 5 spd., A/C, AM/FM cass., 77K mi., orig. owner, ex. cond., \$2,300. 729-4447.

'78 Ford LTD II, \$995; Holmes 500 wrecker, dual winch, \$2,995. Walter, x37332.

Cycles

'82 Honda V-45 Sabre, customized sports tourer, bags, fairs, lowers, etc., black w/metallic grey & silver, \$1,400. Richard, 480-0880.

'87 Suzuki 650 Savage, 1,560 mi., \$1,950 w/helmet. 480-7470 or 280-1641.

Yamaha Moto 4, four wheeler, new cond., \$800. 482-4365.

'85 Honda Elite 80 scooter, good cond., low mi., 80 mpg., w/helmet & cover, \$600. Larry, 554-2209.

Boats & Planes

15' boat, center console w/25hp Evinrude, galv. trailer, trolling motor less than 100 hours on new motor, access., good cond., \$1,800. Don Thompson, x39475 or 941-1537.

16' Hobie Cat, 2 sets of sails, harnesses, trapeze and life jackets, \$1,400. John, 482-6364.

Lease: Floating boat slip, Portofino Harbour, avail. now, up to 40', 5 min. from bay. Ritz, x38501 or 780-2391.

20' boat, center console, w/115hp Johnson eng., incl. all tanks/equip., \$3,500. OBO. Jon, x31709 or 480-8710.

'76 King Fisher bass boat, 15 1/2 x 4, live well, 55hp Johnson, trailer w/new tires, battery, 3 Captain chairs, ex. cond., \$1,800. Diane, x36163 or Jim, 332-1379.

'85 Mistral Malibu windsurfer, \$650. Bullock, 488-6526.

12' Hobie Mono-Cat, trailer, 2 sails, \$950. 333-1762.

Cobaft, twin 260's, SS props, tandem axle trailer, loaded, \$15,800. 488-2829.

Curtis Hawk windsurfer board, great for beginners, good cond., \$300. OBO. Mike, 333-6246 or 474-7217.

Audiovisual & Computers

Full-range auto speaker system, Topline Kicker Super II, ex. cond., contains two tweeters, two 8" woofers, and two 10" passive radiators for ex. bass reproduction, was, \$289, now, \$175. x34333.

Apple II+, Amde K monitor, Z D/drives, joystick, RF modulator, 64K, printer interface cord, software, ex. cond., \$550. OBO. Allen, 554-2788.

Household

Early American couch, good cond., \$50. 482-8827.

Large solid wood bedroom dresser w/large attached matching mirror, \$150. OBO. Tom, 280-1746 or 538-4068.

Old fashioned school desk, \$40; Sears old fashioned small wind-up record player w/records, \$200. Dorothy, 482-1505.

TV stand on rollers, \$20; director's foldup chair, \$10; kitchen table with two matching chairs, \$35; 3 Mahogany upholstered foldup chairs, \$30. 488-5564.

Large antique marble top table, \$850; antique hand-carved folding screen, \$200; old footstool, \$12; antique rose-colored window bench, \$200; 2 matching large carved chairs, new upholstery, \$250 ea. 488-5564.

24% leaded crystal by Tiffin, orig. \$30, per stem, "Encanto Platinum," 8 stems per set, 2 sets ice team & champagne, very nice, \$150. Don Thompson, x39475 or 941-1537.

Electric dryer, good cond., \$70. 488-1998.

Queen size sofa bed, beige, \$150. OBO. Clinton, x31446 or 527-8101, ext. 3337.

Whirlpool washer and dryer, almond, 3 yrs. old., \$300; living room set, 6 pieces, brown, 1 yr. old., \$500. OBO. x34098 or 997-1728.

Wanted

Need riders for van pool, Braeswood & South Post Oak to NASA area, 1988 Dodge van. Richard, x37557.

Need roommate to share expenses in 2 bedroom apartment, 5 min. from JSC. Jon, x31709 or 480-8710.

Want used wet/dry vac in good cond. x31294 or 280-8855.

Want used, working, swimming pool heater. Dean, 282-1918 or 488-7032.

Want 80 column color monitor for the Commodore 128. 488-1444.

Want recliner in good shape, under \$50. Merrell, x37570.

Want to trade \$10,000 electronic organ for land, car, truck, or boat of equal value. OBO. 337-4051.

Musical Instruments

Fender 12 string w/case, \$150; Ovation 6 string w/case, \$185; Peavey classic amp, \$125. Ken, 930-1705.

Pets & Livestock

2 7 wk. old kittens, 1 male, 1 female, both yellow & white w/dark brown tails & ears, very unusual, house raised, healthy. Scott, x35969 or 332-2469.

Labrador retriever, yellow, male, 10 mo., affectionate and playful, all shots, housebroken, free to good home, pref. family. Wolf, 333-6564 or 482-3824.

AKC registered German Shepherds, born May 30, beautiful markings (4), 2 all black. Billie, 482-4365.

Cocker Spaniel, male, AKC, looking to stud female Cocker w/ACK paper. Tamela, x36159 after 3 p.m. or 480-8980 in a.m.

Miscellaneous

Yard sale: August 6-7, 9 a.m. to 5 p.m., 1105 3rd Street, League City. Furniture, plants, kitchen items, clothes, items from NASA and Texas A&M will be for sale. Call Kristen, x38513 or 332-1890, for information.

'52 AMI jukebox, complete oper. manual and schematics incl., fair cond., \$250. Craig, 282-3731 or 485-5636.

G.E. 4 cu. ft. refrig., ex. cond., \$85; rowing machine, \$30; Sears 55 gal. shop vac, \$40; weight bench/weights, \$35. Gene, x33187 or 488-5162.

Membership in San Jo Cove Recreation Center, Lake Conroe, for sale. 550-4112.

Space-Saver tire/wheel, fits General Motors cars, never used, \$30. 488-2735.

Ping pong table, \$45; Panasonic turntable, \$40; over 100 albums, \$2/ea.; telephones, \$15/ea.; BBQ, \$20. 729-4447.

VW type 1 engine, 2110cc, approx. 150hp, run on bench only, all new parts, \$2,150; VW transmission w/Porsche 356 axles, super diff, beef-a-diff, & steel shift forks, never used, \$500. David, 554-2992.

Sanyo 2.8 cu. ft. refrig., \$75; boat anchor, 15 lb. Fluke type, \$18. John, x38890 or 488-0559.

Men's left-handed golf clubs, 2-9 irons, 1.3&4 woods, \$70. OBO. Tom, x31710 or 538-1581.

Tektronix 2236 oscilloscope, w/counter and DVM in one package, ex. cond., \$1,800. Gary Smith, x33572 or 481-4412.

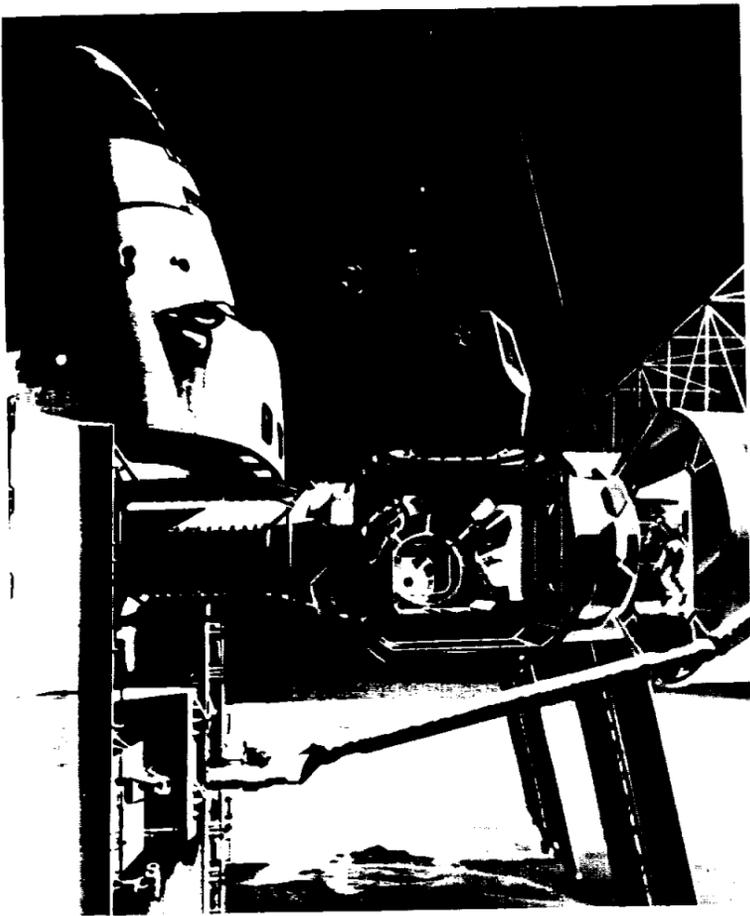
Bicycle carrier, holds 2 bicycles, trunk mount, portable, lockable, fits any car, \$25; front pair KYB gas adjust shocks, for '73-78 280Z, \$30; catalytic converter, fits any auto, \$25. Don Thompson, x39475 or 941-1537.

Man's 14K gold nugget Seiko watch, new, \$850. 482-1582.

Murray 20" cut lawnmower w/3hp Briggs and Stratton eng., used only 5 mo., ex. cond., \$100. x32515.

Oliver front end loader, diesel, \$395; hydraulic trencher attach. for tractor, \$295; tractor trailer, \$495. Walter, x37332.

Weedeater grass trimmer, mod. 1700, w/blade adapter kit, \$50. 482-8827.



Where
TOMORROW
 is
TODAY
In Bldg. 16, Space Station Freedom is already in orbit

By James Hartsfield

Outside the walls of a glass house in space, Space Station Freedom stretches to awe-inspiring limits in all directions, a bright outline of geometry and technology.

It's just another day at work, another job to be done, another task made tedious by the physics of space, as the controller takes his station behind a rainbow of computer graphics. Closed-circuit television brings the far reaches of the Station to his eyes.

A Shuttle has docked early this morning, and now the task is to grapple an Orbital Maneuvering Vehicle with a tenuous robot arm. The image out the windows is mirrored by a graphic image, seen from any angle desired, on the control panel.

This isn't a scene from far above Earth in the 21st century. It's in Bldg. 16 today.

Tomorrow comes quickly here, and the future outside the windows of the new Space Station cupola simulator is so real it can make you duck. Those working on the intricacies of Space Station control are still firmly gripped by Earth, but their minds and imaginations are cartwheeling through zero-G.

A team of about 30 engineers associated with the Systems Engineering Simulator (SES) are the time machine that cupola engineers and designers use to see their ideas in action.

"Our game is to really try to guess what the future is five years from now and start simulating it today," Carl Martin, SES cupola project engineer, said. "A crystal ball helps. We support early, early stuff and try to work as far ahead as we can."

Although the first element of Space Station won't leave Earth until 1995, for Martin and those in SES, time is short. They must provide working mockups of concepts and ideas so

engineers can see if what looks good on paper or in theory holds true in reality.

"We provide a facility where they can work. We're building up their ideas," Martin said. "And we're definitely busy—we're starting to plan our third cupola."

Construction of the second cupola simulator, a six-sided design with two independent work stations, was completed last week. It will be evaluated by a host of engineers working on the project at JSC and elsewhere and by engineers from McDonnell Douglas, contractor for the cupola.

"The design of the cupola is not yet fully determined. How big should it be? What kind of controls should it have? Is this the best design to allow the crew to do their job? This simulator is being used to answer those questions," Martin explained. But inside the simulator, the Space Station has already been built.

The view from the windows is extremely real in its response to controls. "We spent a lot of time developing this simulator to make it very accurate," he said. "We have to be accurate to within a fraction of an inch to actually go in and grapple payloads, which is a big part of the engineering simulation." The cupola will be the primary control center for the Space Station's mobile servicing system with its manipulator arms, for unmanned free flyers approaching or departing the Station, and for the monitoring of extravehicular activities.

Bldg. 16 is awash in simulated spacecraft, and many of them interconnect. The cupola simulator can be integrated with an Orbiter aft deck simulator and a Manned Maneuvering Unit simulator. Any combination of these can work together, such as a crewman piloting the Orbiter while the cupola controller moves the Space Station manipulator arm into

position to grapple the spacecraft.

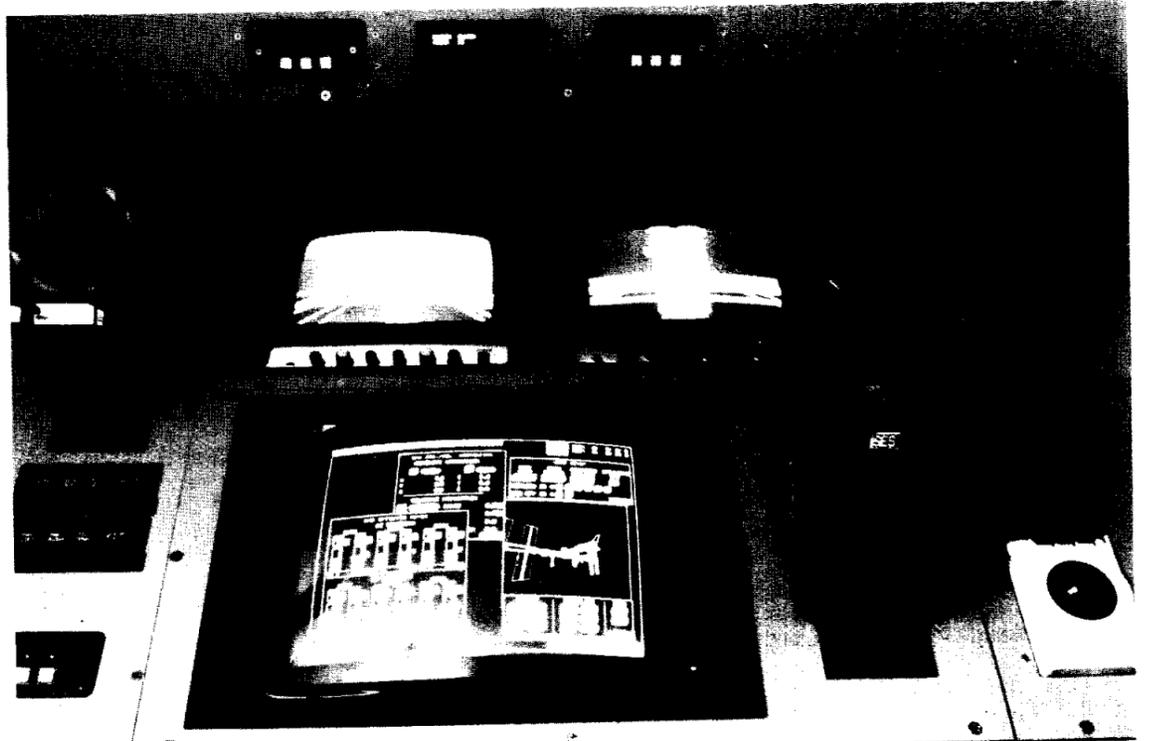
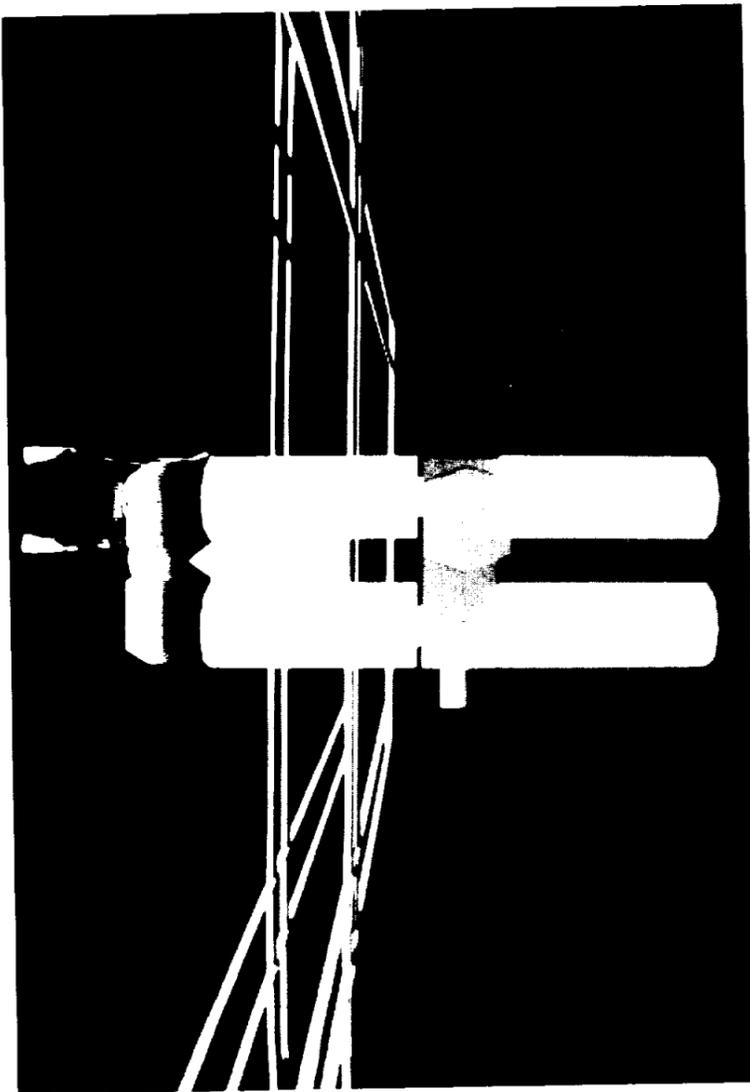
Among the most impressive aspects of the cupola simulator is its "glass cockpit," a design that does away with the hundreds of buttons and toggle switches littering the Orbiter's flight deck. Instead, different computer screens hold various control panels, and the desired panel can be pulled up at will. A computer trackball is used to "push" buttons and activate controls. The programmable controls lead to an extremely clean cupola.

The dual work stations in the current cupola simulator are completely redundant. If one fails, the other can take over. The first cupola simulator in Bldg. 16, built in November 1987, featured only a single work station. The third simulator, already in planning and scheduled to be built late this year, will probably feature dual stations but in an eight-sided, rather than six-sided, cupola shell, Martin said. "We're looking at putting in more, different-shaped windows for a more continuous field of view, and the simulator will be closer to flight size."

The simulations will become ever more realistic. A new optic device will cover all windows of the cupola simulator, providing a bigger, more three-dimensional field of view for the operator.

But the pride and joy of Bldg. 16 is a recently purchased scene generator, the most up-to-date equipment of its kind. The Evans and Sutherland CT6 scene generator creates very realistic images of the Orbiter, Moon, Earth, Sun, stars and Space Station which appear outside the cupola windows. It should be in use within two months.

"The clouds move above the Earth, and there are realistic craters on the Moon. The CT6 is a big advancement over our 12-year-old current system," Martin said.



Top left: An artist's concept of one of many designs under study for the Space Station cupolas. Top right: Engineer Carl Martin shows off the latest dual work station cupola simulator in Bldg. 16. Bottom left: The view from the windows of the cupola simulator shows the Station stretching in all directions. Bottom right: The "glass cockpit" design of cupolas allows for uncluttered work areas.

JSC Photos by Sheri Dunnette

Balloons search for signs of antimatter galaxies

NASA will launch three huge balloons in Canada this month to search for cosmic rays, including those that could provide evidence of galaxies made of antimatter.

Antimatter consists of particles with electrical charges opposite those of "common" matter, which constitutes Earth's material. When antimatter and matter collide there is a mutual and complete annihilation, releasing energy far greater in proportion than energy released by nuclear fission or fusion.

Whether antimatter could ever be created in sufficient supply and harnessed to provide useful energy is a challenging question.

The flights began this week, and the month-long campaign is part of the Balloon Program managed by the Goddard Space Flight Center's Wallops Flight Facility in Wallops Island, Va.

Balloons that will lift three cosmic ray experiments to about 120,000 feet will be launched from Prince Albert Saskatchewan Airport, about 300 miles north of the U.S.-Canadian border.

Scientific balloons are utilized to carry large research payloads with scientific instruments to make measurements at altitudes above 99 percent of the Earth's atmosphere. They are made of a thin polyethylene

material and are more than 350 feet in diameter at full inflation. These balloons provide unique experiment platforms for measurements at altitudes in the upper stratosphere.

Personnel from WFF and the National Scientific Balloon Facility, Palestine, Texas, will provide the launching and operational flight support at the primary operations site in Prince Albert. Personnel from WFF also will provide downrange telemetry tracking support at Edmonton, Alberta.

Principal investigators for this campaign are Dr. Steve Ahlen, Boston University; Dr. W. Robert Binns, Washington University; and Dr. Steve Schindler, California Institute of

Technology.

Ahlen's extragalactic antimatter experiment is a 4,500-pound payload that will search for heavy anti-nuclei (anti-silicon to anti-iron), and will be flown on a 28.4 million cubic foot balloon. The observed anti-nuclei are expected to provide evidence for the existence of galaxies made completely of antimatter. Scientist believe this discovery could prove to be extremely useful for understanding the annihilation process between matter and antimatter in the creation of galaxies.

Binns' payload, called the scintillating optic fiber experiment is a 1,200-pound cosmic ray isotope experiment that will utilize newly developed range

and trajectory-defining detectors based on scintillating fiber optics. It also will be carried aloft by a 28.4 million-cubic-foot balloon.

Schindler's 2,700-pound payload, to be carried on a 23.3 million-cubic-foot balloon, is the high energy isotope spectrometer telescope. This experiment employs a combination of scintillators and counters to form a cosmic ray isotope spectrometer capable of measuring the isotopic composition of cosmic rays from helium to nickel.

The mission is part of the overall NASA Balloon Program, managed at Wallops. The program provides 40-45 balloon flights a year from locations around the world.

Test of engines for *Discovery* is rescheduled

Test officials are checking for hardware malfunction

(Continued from Page 1)

Failure of the valve to close would have allowed high discharge pressure to enter venting back to the External Tank. That venting is not designed to withstand those pressures, Lombardo said.

"In examining the data, and comparing it to the other two engines, we did find that the valve was what we term 'sluggish' in its rate of closure," Lombardo said.

Test officials are evaluating whether the valve failed to close because of a hardware malfunction in either the valve itself or the sensor measuring the position of the valve, or whether it was influenced by the coldness of the boattail, Lombardo

said. If there was a hardware failure, an on-the-pad removal and repair or replacement of the valve would be necessary. If the problem appears to be related to the cold, the problem may be able to be compensated for by changing the time at which the valve position is examined or changing the valve position criteria.

Thursday's test was to have been the sixth FRF for the Shuttle Orbiters. FRF's are normally conducted only once to certify that all Orbiter launch systems work properly once integrated. This firing was scheduled to be sure all systems were working properly in spite of the standdown since the Jan. 28, 1986, *Challenger* accident.



JSC Photo

SPACE ACT AWARD—A team of JSC workers recently received a combined \$24,500 in a Space Act Award for their work on the Payload Support System, a system for display of payload engineering, science and safety data. Shown with certificates they received along with the \$3,500 given to them each are front row, from left: Thomas Keeton, Patrick Duffin and Ray Loree from mission support, Rockwell workers Margaret Beain and Trent Mills, and Maurice Kennedy from mission operations. On the back row are Mission Support Director Ron Berry, Mission Operations Director Gene Kranz, Robert Minor from Rockwell, and JSC Director Aaron Cohen. Not pictured is James Gauthier, mission operations.

Sites for advanced solids chosen

The government sites for the production and testing facilities for the planned Space Shuttle Advanced Solid Rocket Motor (ASRM) were recently selected.

The Tennessee Valley Authority property known as Yellow Creek, in northeastern Mississippi, was selected for the location of the ASRM production facility, while Stennis Space Center has been selected as the test site of the motor.

These sites will be identified as the government sites in a Request for Proposals (RFP) to be issued in the near future for the design, development, test and evaluation of the ASRM. The companies responding to the RFP must use the selected location as the basis for their proposals to build a government-owned, contractor-operated facility, as well as a required proposal of a privately financed option for the required facility.

In addition to the government sites, the ASRM acquisition plan encourages interested companies to submit an optional proposal for a privately owned solid rocket motor facility at a site of the offeror's choice.

Maximum use also will be made of available manufacturing and computer capability at the Michoud Assembly Facility and the Slidell Computer Complex, both located in southeast Louisiana, to minimize total program costs. It is estimated that job opportunities for about 1,400 people in the northeast Mississippi area and employment of an additional 600 people in the area east of New Orleans could result.

Marshall Space Flight Center Director J.R. Thompson Jr. made the selections with the concurrence of NASA Headquarters following several months of evaluation by a NASA ASRM Site Evaluation Board. The board, headed

by Larry Ross, deputy director of the Lewis Research Center, was formed to consider sites at Yellow Creek, Stennis and Kennedy Space Center. The board was instructed to consider at least the following factors: transportation for raw materials and furnished products; construction costs, including any costs to acquire or adopt the site; environmental constraints; expansion capability, including a buffer zone; support infrastructure; utilities availability; availability of suitable labor base; industrial and public safety; and security.

The planned ASRM, which will replace the current Redesigned Solid Rocket Motors in the mid-1990s, will incorporate substantive design changes to improve the reliability and safety margins, as well as provide a significant added performance capability to the Space Shuttle.

Program sends five to Washington

(Continued from Page 1)

Goodrich, a 21-year JSC employee, reported to the Aerodynamics Division, where he will serve as special assistant for aerothermodynamic program development. He will be responsible for identifying long term aerothermodynamic research needs and program planning.

Villarreal, who has been at JSC for four years, reported to the Automated Information Management (AIM) Program Office earlier this year. He will be working with the AIM program to institutionalize large computer programs for the use of all NASA centers. He will design systems, like the new payroll and accounting system, to be

portable to all centers.

Bungo, an eight-year JSC employee, will report to the Life Sciences Division in Washington later this fall. His assignment is yet to be determined.

Participants in the program are chosen through a competitive selection process.



NASA Photo

This is the leaking dynatube fitting inside *Discovery's* Orbital Maneuvering System pod, as photographed using a Borescope, nicknamed a "Cobra," that was snaked inside the pod.

Leak may be fixed at pad using clamshell approach

(Continued from Page 1)

clamshell, surrounding the leak spot. We pump it in under pressure and it cures in that condition. We have propellant and high pressure helium inside the tube just like at the Cape, and it's working through that leak to try to find its way out of that clamshell but it's not doing it. We feel pretty good about it."

Morris said it has been exciting to see how well NASA can operate under stress.

"Some of these young people have been here a couple of years and we've put them through all the red tape and paperwork. Now we get a crisis like this and we do a lot of shortcuts; we still work all those in, but we do a lot of shortcuts on how nice they look and how many places they have to go for signatures. They've gotten a whole different viewpoint on how we do business, the way we used to do business. When there's a critical situation we work a little differently."

Space News Roundup

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Respite in price is over, soft drinks go to 55 cents

The respite is over—canned soft-drink prices are back up to 55 cents in JSC's vending machines.

Teresa Sullivan, manager of JSC Exchange Operations, said the introductory offer of new concessionaire ARA Vending Services expires this weekend. Effective Aug. 6, the price will increase a nickel from the current 50 cents.

There is a silver lining to this carbonated cloud, as ARA is now beginning promotions that offer free T-shirts, travel mugs and other items through

the vending machines.

Sullivan said the T-shirts will turn up in place of the soft-drinks in some cans. The winners will then be able to make their selections without paying an additional 55 cents.

Travel mugs will be offered on the cold cups containing iced drinks. Special stickers on the cups will let winners know how to claim their prizes.

ARA took over the concession contract on Jan. 6, promising a six-month hiatus in soft-drink prices. ARA's contract runs through Jan. 5, 1989.